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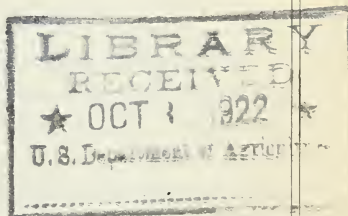
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DEPARTMENT CIRCULAR 230

HOME TANNING

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HOME TANNING.

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INTRODUCTION.

DURING the last few years the United States Department of Agriculture has received numerous requests from farmers and ranchmen for directions for tanning on a small scale. Under normal conditions it seems better economy for the farmer and rancher to confine their efforts to improving the quality of the raw material for leather (the hides and skins) and to marketing it most advantageously, rather than to undertake tanning, which requires time and equipment and, for the inexperienced operator, involves the risk of loss of hides and labor.

The handling of hides and skins includes the operations of skinning, curing, and marketing, each one of which affects the value of the raw material. It is, therefore, to the farmer's interest to perform these operations in the most efficient manner possible. This can be done by following the instructions given in Farmers' Bulletin 1055, Country Hides and Skins: Skinning, Curing, and Marketing. Fall, winter, and spring "take-off" hides, if well cured, may be stored in a cool cellar until May or June without undue deterioration. Before folding a hide for storage after salting, it should be left spread out flat until it is drained free from brine and has become "salt-hard" or "salt-firm."

This condition, which is reached within one or two weeks, can be easily recognized by the "stiff" or "firm" feel of the hide. After thus curing and folding them, the hides can be safely kept in a cool place until there is a sufficient number to sell advantageously or until prices are most favorable. As a general rule, however, it is inadvisable to keep hides over the summer. It is well to remember that there is no oversupply of domestic hides. The country can use and almost certainly will need all that are obtainable. On any

fair and equitable basis of trade, better quality hides and skins should bring better prices.

All too often leather goods, even on the farm or ranch, are extravagantly neglected, so that they soon wear out. Proper selection and, more especially, proper care of leather articles offer a real means of economy. The longer harness, belts, boots, shoes, and other leather articles last, the lower will be the cost of leather. Farmers' Bulletin 1183, *The Care of Leather*, tells how to make leather last.

Copies of Farmers' Bulletins 1055 and 1183 may be had free upon request to the Division of Publications, United States Department of Agriculture, Washington, D. C.

HAVING HIDES TANNED.

It may be more economical to have hides and skins tanned by tanners who are willing to tan one or more hides than to do the work on the farm or ranch. Some of these tanners tan only hides with the hair on for robes or coats; some also tan harness, strap, lace, and glove leather; others tan only harness, strap, or lace leather; a few tan sole leather. Some of them accept one-half of the hide in payment for tanning the other side. That is, if you send them a hide, they will send you back one-half tanned into harness, strap, or lace leather, keeping the other half to pay for their work. This probably is the best way for the farmer to get his leather.

Depending on the size of the hide, the kind of leather, and the tanner's costs and profits, the charge for tanning a hide with the hair on or making it into leather varies from \$1.50 to \$4 for calfskins, and from \$5 to \$8 a hide, or from 25 to 50 cents a square foot or a pound for horse and cattle hides tanned into harness, lace, or glove leather.

Definite prices can be obtained directly only from a tanner. *In writing to tanners be sure to state exactly what kind of hides you have, give the weight of each, and ask for prices for tanning them with the hair on, making them into robes or coats, or for tanning them into the kind of leather you want.* The hide you have may not be suitable for the kind of leather you want. It takes a 50-pound or heavier hide to make sole or harness leather. If you tell the tanner what you have, he can tell you what it will make. A list of tanners who will tan leather and furs for farmers will be furnished upon application to the Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C. In supplying this list of names and addresses, the department assumes no responsibility for the reliability or quality of work of these tanners. The list simply gives the names of all of those who have informed the Bureau of Chemistry that they will tan one or more hides for farmers.

As a rule, the tanner does not pay shipping charges either way. This must be paid, in addition to the charge for tanning.

The regulations for shipping hides by express are now very stringent. The express companies will not accept hides for shipment unless they are packed in a keg or other container that does not leak. Consult the nearest express agent about this before shipping.

Be certain to securely tag each hide before it is shipped with your name and address and the *kind of leather* you wish made from it. Write plainly, using ink or indelible pencil and a tough linen tag with a reinforced eyelet. If the tag comes off or becomes illegible you probably will lose the hide.

BUYING LEATHER BY THE SIDE.

Many farmers state that they are offered only 1 to 4 cents a pound for hides, but are charged from 90 cents to \$1.50 a pound for leather at retail. It may prove more economical in many cases to purchase, either individually or cooperatively, leather in quantities larger than a pound or two.

The wholesale prices for leather made from country hides are now quoted (June 1, 1922) about as follows: Sole leather in sides, 21 to 35 cents a pound; harness leather in sides, 30 to 45 cents a pound; calf upper leather, 20 to 42 cents a square foot; lace leather, about 20 cents a square foot from small tanners. Leather made from packer hides usually sells for more than that made from country hides. Wholesale prices fluctuate from time to time. Definite information as to prices at time of purchase must be obtained from dealers or tanners.

By buying a single side of leather as he needs it, the farmer should be able to get it at a price not more than 10 to 20 per cent above these prices. You must, of course, pay expressage on the leather bought from the tanners. It is usually more satisfactory to see the leather before buying it. If whole sides can not be obtained from dealers in the nearby cities or towns at satisfactory prices, write the tanners for their prices.

Sole leather is known as oak, union, hemlock, and chrome tanned, and is classed as heavy, medium, and light. For quality it is graded No. 1, No. 2, and No. 3. Chrome sole leather can be bought waxed or unwaxed. Only the waxed is suitable for outdoor use. Harness leather is heavy, medium, and light, and for quality it is graded No. 1 and No. 2, or A and B.

A "side" of leather is half of a tanned hide. It weighs from 15 to 30 pounds, depending upon the size of the hide and the kind of leather. A "back" is a side of leather with the belly, legs, and

head trimmed off. Backs cost a little more than sides (3 to 6 cents a pound). A "bend" is a side of leather with the belly, legs, and shoulder trimmed off. It is the best leather of the hide and is approximately one-half the area or weight of the side. Bends cost considerably more than either backs or sides.

A comparison of the prices at which leather can be bought with the charges for having hides tanned will show which is cheaper. As a general rule, it is believed that it will be cheaper to have hides tanned one half for the other.

SMALL-SCALE TANNING.

Usually the tanning of a few hides or skins by inexperienced persons or those lacking adequate facilities can not be recommended from the viewpoint either of national economy or of individual profit. The tanners know how and are equipped to make all the leather the country needs. They can make better leather more economically than the farmer can.

Sometimes, however, the products of the farm and the ranch sell for less than the cost of production. For example, "country" hides could hardly be given away during 1921; yet leather in small pieces cost the farmer from \$1 to \$1.50 a pound. Under these conditions the farmer and the rancher naturally feel that they must attempt to work up their raw materials or else do without the finished products. As a result the Department of Agriculture has received thousands of requests for directions for home or farm tanning. In response to this persistent, growing, and widespread demand, the following directions for tanning a hide or two, with only such facilities as can be readily had on the farm or ranch, have been prepared. No directions are given for tanning fur skins, hides with the hair on, or hides for robes and coats. It is believed that an inexperienced person should not undertake the tanning of such skins or hides, as the difficulties in tanning, and especially in properly finishing them, are so great as to make the chances of success very remote.¹

Although good serviceable leather has been made in the Bureau of Chemistry, with the equipment and directions here described, the inexperienced operator will probably often be unsuccessful. Every attempt, however, through close observation and experimenting, should add to his experience and reduce the number of his failures. Operating on a small scale, he can not hope to obtain leather equal in appearance and possibly quality to that on the market, but he should be able to obtain leather of service for many purposes on the farm.

¹ Farmers' Bulletin 1020, Rabbit Raising, a copy of which may be had free upon request to the Division of Publications, U. S. Department of Agriculture, Washington, D. C., contains a formula for tanning which may be applied to small fur skins.

It will also probably be found necessary at times to modify these directions, especially as to equipment, to suit conditions or in tanning other kinds of leather. Success in this will depend largely upon the experience and ingenuity of the individual.

GENERAL INFORMATION.

Complete directions are given in this circular under each method of tanning described. This results in repeating the description of some operations which are common to nearly all methods of tanning, but the repetition is necessary to avoid the confusion that otherwise would result from disconnected directions. The details essential in explaining the numerous steps should not prove confusing. The directions need not, of course, be memorized, but they should be carefully studied until they are thoroughly understood before the operation is begun. All supplies and equipment should be obtained and plans should be fully made before beginning the work.

Unless otherwise specified, tanning operations are best done at a uniformly moderate temperature. A cellar which is naturally fairly warm in winter and cool in summer is a suitable place. For convenience there should be a handy supply of fresh water and also a drain. All the operations can be done in tight, clean wooden barrels, preferably oak, of 40 to 60 gallons capacity. When not in use the barrels should be kept clean and full of water. Half barrels and wooden or fiber buckets and tubs are very convenient for many purposes. Iron containers should never be used.

HIDES AND SKINS.

The hide or skin may be started in process as soon as it has been taken-off, drained, and cooled from the animal heat. Overnight will be long enough. If you are not ready to begin tanning, or if you have at one time more hides than you can handle, they can be kept safely for three to five months in a thoroughly salted condition. During storage or tanning the hides must never be allowed to freeze or heat. Some tanners claim that salting before tanning is helpful, and it will certainly not do any harm to salt the hide for a few days before tanning.

The kind of leather which can be made from a hide or skin depends largely upon its weight and size. The tanning trade makes distinctions in hides and skins based mainly upon the size and age of the animal and upon the class of leather. Hides from the larger and adult animals are suitable for sole, harness, belting, or heavy leathers. Skins from the smaller animals, such as sheep, goats, calves, and deer, are made into light and fancy leathers. While there are other commercially important sources of hides and skins, the most important ones, with the exception of furs, are the usual domesti-

cated farm and range animals. As a general rule, the thickness of the finished leather will be about that of the untanned hide and this should be a guide in selecting skins for different kinds of leather.

The first essential for a satisfactory yield of good leather is a good, sound, clean hide or skin. Skinning should be done properly, without cutting or scoring the hide, at the same time leaving on it no fat and meat which must be removed later before tanning and which if left on increases the chances of spoiling or rotting the hide. Directions for skinning hides and skins, contained in United States Department of Agriculture Farmers' Bulletin 1055, should be studied in this connection.

BARK-TANNED SOLE AND HARNESS LEATHER.

Read the directions through before starting this work.

These directions have been prepared for tanning a single heavy cow, steer, or bull hide, weighing from 40 to 70 pounds, into bark-tanned leather suitable for sole, harness, or belting.

SLAKING LIME.

Put 6 to 8 pounds of burnt or caustic lime in a clean half barrel, wooden tub, or bucket, of at least 5 gallons capacity. Use only good-quality lime, free from dirt and stones and never air-slaked. To the lime add about 1 quart of water. As the slaking begins, add more water, a little at a time, to keep the lime moist; do not pour in water enough to quench the slaking. After the lime appears to be slaked, stir in 2 gallons of clean water. Do all this just exactly as you would make whitewash. Slake the lime on the day before you start soaking the hide, and keep the limewater covered with boards or sacks until ready to use.

If available, fresh hydrated lime, not air-slaked, may be used instead of slaking burnt or caustic lime. In this case use 8 to 10 pounds in 4 or 5 gallons of water.

SOAKING AND CLEANING.

If the hide has been salted, shake it vigorously to remove most of the salt. Spread it out, hair side down, and trim off the tail, head, ears, all ragged edges, and shanks.

Place the hide, hair side up, lengthwise, over a smooth log or board, and, with a sharp knife, split it from neck to tail, straight down the backbone line, into two half hides, or "sides." It will be more convenient in subsequent handling, especially when the hide is large, to then split each side lengthwise through the "break," just above the flanks, into two strips, making the strip with the backbone edge about twice as wide as the belly strip. Thus a whole hide will

give two sides or four strips. In these directions the "side" should be taken to mean either side or strip, as the case may be.

Fill a 50-gallon barrel with clean, cool water. Hang the sides, flesh out, over short sticks and suspend them in the barrel of water to soak for two or three hours. Stir them about frequently to soften, loosen, and wash out the blood, dirt, manure, and salt. (The short sticks or pieces of rope may be held in the proper position by tying a loop or cord on each end and catching the loops over nails in the outside of the barrel near the top.) After soaking for about three hours, take out the sides, one at a time, and place them, hair side up, over a "beam." (A ready-made beam can be purchased, but a fairly satisfactory one can be made from a very smooth slab, log, or thick planed board from 1 to 2 feet wide and 6 to 8 feet long. The slab or log is inclined, with one end resting on the ground and the other extending over a box or trestle so as to be about waist high.) With the side lying hair side up over the beam, scrub off all dirt and manure, using if necessary a good stiff brush; then wash off with several bucketfuls of clean water.

Now turn the side over, flesh side up, and scrape or cut off any meat or flesh. Work over the entire flesh side with the back edge of a drawing or butcher knife, held firmly by both ends while pushing away from you hard against the hide or skin. Wash off with a bucket or two of clean water. This working over should always be done. Refill the soak barrel with clean, cool water and hang the sides in it as before, working them about frequently until they are soft and flexible. A green or fresh hide usually needs to be soaked for not more than 12 to 24 hours; a green salted hide for not more than 24 to 48 hours.

When the sides are properly softened throw them over the beam and thoroughly scrape off all remaining flesh, fat, or meat. It is of the greatest importance to remove all this meat. When it can not be scraped off, cut it off, but be careful not to cut into the hide itself. Even should there appear to be no flesh to take off and nothing appears to be removed, it is necessary to thoroughly work over the flesh side in this way with the back of a knife. Finally wash off with a bucketful of clean water.

The hide must be soft, pliable, and clean all over before being put into the lime.

LIMING TO REMOVE THE HAIR.

Wash out the soak barrel and pour into it all of the slaked lime. Nearly fill the barrel with clean, cool water, and stir thoroughly. Hang the sides or strips again over the short sticks or pieces of rope, hair side out, and suspend them in the barrel so that they are completely covered by the limewater. See that the sides are suspended

with as few folds or wrinkles as possible and also be sure not to trap any air under the sides. Keep the barrel covered. Plunge the hides and stir the limewater three or four times each day until the hair will come off easily. This will take from 6 to 10 days in summer and possibly as many as 16 days in winter. When thoroughly limed the hair can be rubbed off readily with the hand. Early in the liming process it will be possible to pull out the hair, but the hide must be left in the lime until the hair comes off by rubbing over with the hand. For harness and belting leathers leave the hide in the limes for three to five days after this condition has been reached.

When limed, throw the side, hair side up, over the beam, and, with the back edge of a drawing or butcher knife, held nearly flat against the hide, push off the hair from all parts of the hide. If the side is sufficiently limed, a curdy or cheesy layer of skin rubs off with the hair. If this layer does not rub off, the side must be returned to the limewater. After removing the hair, put the side back again for another day, until any fine hairs that may remain can be easily scraped off. Now thoroughly work over the grain or hair side with a dull-edged tool to "scud" or work out as much lime, fat, and dirt as possible. Then turn the side over and do the same thing, being sure to remove all fleshy matter. Shave down to the hide itself by scraping or by using a very sharp knife with a motion somewhat like that of shaving your face. Rinse off both sides of the hide with clean water. Wash the hide in cool, clean water for 6 to 8 hours, changing the water frequently, and then proceed as under "Deliming."

The lime, limewater, sludge, and fleshings from the liming process may be used as fertilizer, being particularly good for acid soils. The hair, as it is scraped from the hide, may be collected separately, and, after being rinsed several times, may be used in plastering. If desired, it can be thoroughly washed with many changes of water until absolutely clean and, after drying out in a warm place, can be used for padding, upholstering, insulation of pipes, etc.

DELIMING.

Buy 3 ounces of U.S.P. lactic acid (or 9 ounces of tannery 22 per cent lactic acid). Nearly fill a barrel with clean, cool water and stir in the lactic acid. Now hang in the unhaired sides or strips. Pull them up, and stir frequently for about 24 hours. Take out the sides, work over, "scud" them thoroughly as directed under "Liming" and hang them in a barrel of cool water. Change the water several times, and finally leave them in the water overnight.

If lactic acid can not be obtained, use one-half gallon of vinegar instead.

TANNING.

The hide or sides are now ready for the actual tanning. From 15 to 20 days before this stage is reached weigh out 30 to 40 pounds of good-quality, finely-ground oak or hemlock bark and pour onto it about 20 gallons of boiling water. (Finely-ground bark, with no particles larger than a grain of corn, will give the best results. Simply chopping the bark into coarse pieces will not do. Do not let the tan liquor come in contact with iron vessels. Use the purest water available. Rain water is best.) Let this bark infusion stand in a covered vessel until ready to use. Stir it up occasionally. When ready to start tanning, strain off the bark liquor through a clean, very coarse sack into the tanning barrel. Fill the barrel about three-fourths full with water, rinsing the bark with this water so as to get out as much tannin as possible. Add 2 quarts of vinegar. Stir well. Hang the sides or strips, from the deliming, over sticks, and suspend them in this tanning liquor with as few folds and wrinkles as possible. Move the sides about and change their position often so as to get an even color. Just as soon as this has been started, weigh out the same quantity of ground bark and soak it with hot water as before. Let this second bark liquor stand until the sides have become evenly colored, or for from 10 to 15 days. Then add one-fourth of the second bark liquor, taking out from the tanning barrel first the same amount of old liquor as you are going to add of the new or second bark liquor. Also add about 2 quarts more of vinegar and stir it in well. After five days add another fourth of the tan liquor only (no vinegar); do this every five days until the liquor is used up.

About 35 days after the actual tanning has been started, the sides are ready for the first bark. (The progress of the tanning varies somewhat with conditions and can best be told by inspecting a small sliver cut from the edge of the hide. The fresh cut should show two somewhat dark or brown streaks coming in from each surface of the hide. These streaks will be rather narrow, about as wide as a heavy pencil line.) Weigh out about 40 pounds of fine bark and just moisten it with hot water. Do not add more water than the bark will soak up. Pull the sides out of the tan liquor and dump in the moistened bark, keeping as much of the old tan liquor in the barrel as possible. Mix thoroughly, and while mixing hang the sides back in the barrel. Actually bury them in the bark; all parts of the sides must be kept well down in the bark mixture. Leave the sides in this bark for about six weeks, moving them about once in a while.

After six weeks pull the sides out (a cutting should show that the tanning has spread nearer to the center); pour out about half the liquor. Stir the bark in the barrel, hang the sides back, and fill the barrel with fresh finely-ground bark. Leave the sides in for about

two months, shaking the barrel from time to time and adding bark and water as needed to keep the sides completely covered.

At the end of this time the hide should be evenly colored all the way through, without any white or raw streak in the center of a cut edge. If it is not struck through it must be left longer in the wet bark and more bark may be necessary. For harness, strap, and belting leather the sides may be taken out of the tan liquor at this stage, but for sole leather they must be left for two months longer. When fully tanned through the sides are ready for finishing.

FINISHING.

Harness and belting leather.—Take the sides from the tan liquor, rinse them off with water, and scour the grain side with plenty of warm water and a stiff brush. This must be very thoroughly done until most of the tan liquor and water has been rubbed or pressed out. Then go over the sides with a “slicker,” working them out on the grain side in all directions. (A slicker can be made from a piece of copper or brass, about one-fourth inch thick, 6 inches long, and 4 inches wide. One long edge of the slicker is mounted in a wooden handle and the other long edge, well rounded, is used to work over the sides by pushing hard against them and away from yourself.) For harness, belting, and the like this scouring and slicking out must be thoroughly done. When the sides are still damp, but not very wet, go over the grain side with a liberal coating of neat’s-foot or cod oil. Hang up the sides and let them dry out slowly. When dry, take them down and dampen them well by dipping in water or rolling up in wet sacking or burlap. When uniformly damp and limber, evenly brush or mop over the grain side a thick coating of a dubbin made by melting together about equal parts of cod oil and tallow or neat’s-foot oil and tallow. When cool this dubbin must be soft and pasty but not liquid, and it must be melted before using and applied warm. Hang up the sides again and leave until thoroughly dried. When dry, remove the tallow from the grain by working over with the slicker. If more grease in the leather is desired, dampen back and apply another coating of the dubbin, giving a light application also to the flesh side. When again dry remove the tallow. Rubbing over with sawdust will help to take up any surface oiliness.

If it is desired to blacken the leather, this must be done before greasing. A black dye solution can be made by dissolving one-half ounce of water-soluble nigrosine in $1\frac{1}{2}$ pints of water, with the addition, if handy, of several drops of ammonia. Evenly mop or brush this solution over the dampened but ungreased leather, and then grease as directed in the preceding paragraph.

Sole leather.—Take the sides from the tan liquor and rinse them off thoroughly with clean water. Press out most of the water and hang them up until they are only damp; then apply a good coating of neat's-foot or cod oil to the grain side. Again hang up until thoroughly dry.

When repairing shoes with this leather it is advisable, after cutting out the piece for soling, to dampen and hammer it down well, and then, after putting it on the shoe, to make it waterproof and more serviceable by setting the shoe for about 15 minutes in a shallow pan of melted grease or oil. The grease or oil must not be hotter than the hand can bear. Any good oil or grease will do, and the following simple formulas have been found to be satisfactory:

Formula 1:	
Neutral wool grease-----	Ounces. 8
Dark petrolatum.....	4
Paraffin wax-----	4
Formula 2:	
Petrolatum -----	16
Beeswax-----	2
Formula 3:	
Petrolatum -----	8
Paraffin wax-----	4
Wool grease-----	4
Crude turpentine gum (gum thus)-----	2
Formula 4:	
Tallow-----	12
Cod oil-----	4

CHROME-TANNED LEATHER.

Read the directions through before starting this work.

For many purposes chrome-tanned leather is considered to be as good as the more generally known bark- or vegetable-tanned leather. The chrome process which requires only a few weeks as against as many months for the bark-tanning process, derives its name from the use of chemicals containing chromium or "chrome." It is a chemical process requiring care and attention. It is felt, however, that by adhering strictly to the directions here given, never disregarding details which may seem unimportant, a satisfactory and serviceable leather can be produced in a comparatively short time. The saving in time seems sufficient to justify a trial of the procedure.

SLAKING LIME.

For each hide, and for not more than three small skins, put 8 pounds of lump, burnt, or caustic lime in a clean half barrel, wooden tub, or bucket, of at least 5 gallons capacity. Use only good-quality

lime, free from dirt and stones and never air-slaked. To the lime add about 1 quart of water. As the lime begins to slake, add more water, a little at a time, to keep the lime moist; do not pour in enough water to quench the slaking. After the lime appears to be slaked, stir in 2 gallons of clean water. Do all this just exactly as you would make whitewash. Slake the lime on the same day that you start soaking the hide or skin, and keep the limewater covered with boards or sacks until ready to use.

If available, fresh hydrated lime, not air-slaked, may be used instead of slaking burnt or caustic lime. In this case use 10 pounds in 4 or 5 gallons of water.

SOAKING AND CLEANING.

If the hide has been salt-cured, shake it vigorously to remove most of the salt. Spread it out, hair side down, and trim off the tail, the head back of the ears, shanks, and all ragged edges.

Now swing the hide or skin, hair side up, lengthwise, over a smooth log or board, and, with a sharp knife, split it from neck to tail, straight down the backbone line, into two half hides, or "sides." If the hide is large or "spready," it is more convenient to split each side lengthwise into two strips, making the strip with the backbone edge about twice as wide as the belly strip. Thus a whole hide will give two sides or four strips. In these directions the word "side" should be taken to mean either side or strip, as the case may be.

For a medium or large hide fill a clean 40- to 50-gallon barrel with clean, cool water; for a small skin a half-barrel or tub may be used. Hang the sides over sticks or pieces of rope and suspend them in the barrel of water to soak for two or three hours. Stir them about frequently to soften, loosen, and wash out the blood, dirt, manure, and salt. (The sticks or pieces of rope may be held in the proper position by tying a loop of cord on each end and catching the loops over nails in the outside of the barrel near the top.) After soaking for about three hours, take out the sides and place them, one at a time, hair side up, over a "beam." (A ready-made beam can be purchased, but a fairly satisfactory one can be made from a very smooth slab, log, or thick planed board, from 1 to 2 feet wide and 6 to 8 feet long. The slab or log is inclined, with one end resting on the ground and the other extending over a box or trestle so as to be about waist high.) With the side lying hair side up over the beam, scrub off all dirt and manure, using if necessary a stiff brush; then wash off with several bucketfuls of clean water.

Now turn the side over, flesh side up, and scrape or cut off any flesh remaining. Work over the entire flesh side with the back edge of a drawing or butcher knife, held firmly by both ends while pushing

away from you hard against the hide or skin. Wash off with a bucket or two of clean water. This working over should always be done, as it helps to soften the hide. Refill the soak barrel with clean, cool water, and hang the sides in it as before, working them about frequently until they are soft and flexible. A green or fresh hide usually needs to be soaked for not more than 12 to 24 hours; a green salted hide for not more than 24 to 48 hours.

When the sides are properly softened, that is, about like a fresh hide or skin, throw them over the beam, and again work over the flesh side with the back edge of a knife as directed before.

Hides and skins must be soft, pliable, and clean all over before being put into the lime.

LIMING TO REMOVE THE HAIR.

Wash out the soak barrel and pour into it all of the slaked lime. Nearly fill the barrel with clean, cool water, and stir thoroughly. Hang the sides again over the short sticks or pieces of rope, hair side out, and suspend them in the barrel so that they are completely covered by the limewater. Cover the barrel with boards or bags. Plunge the hides and stir the limewater three or four times each day until the hair will come off easily. This will take from 6 to 10 days in summer and from 6 to 16 days in winter. When thoroughly limed, the hair can be rubbed off readily with the hand. Early in the liming process it will be possible to pull out the hair, but the hide must be left in the lime until the hair comes off by rubbing over with the hand.

When limed, throw the sides, hair side up, over the beam, and, with the back edge of a drawing or butcher knife, held nearly flat against the hide, push off the hair from all parts of the hide. If the hide is sufficiently limed, a curdy or cheesy layer of skin rubs off with the hair. If this layer does not rub off, the sides must be returned to the limewater. Now thoroughly work over the grain or hair side with a dull-edged tool to get out as much lime, grease, and dirt as possible. Then turn the side over and do the same thing, being sure to remove all fleshy matter. Shave down to the hide itself, but be careful not to cut into it. Remove the flesh by scraping or by using a sharp knife with a motion like that of shaving your face. Rinse off both sides of the hide with clean water.

For sole, belting, and harness leathers, soak and wash the hide in cool water for about six hours, changing the water four or five times, and then proceed as directed under "Drenching."

For strap, upper, and thin leathers, put the limed white hide or skin into a wooden or fiber tub of clean, lukewarm (about 90° F.) water for four to eight hours, depending upon the size of the hide

or skin, and stir about occasionally. Be sure not to get the water too hot, never so hot that it is uncomfortably warm to the hand. After this treat the hide or skin as directed under "Drenching."

The lime, limewater, sludge, and fleshings from the liming process may be used as fertilizer, being particularly good for acid soils. The hair, as it is scraped from the hide, may be collected separately, and, after being rinsed several times, may be used in plastering. If desired, it can be thoroughly washed with many changes of water until absolutely clean and, after drying out in a warm place, can be used for padding, upholstering, insulation of pipes, etc.

DRENCHING.

Drenching is necessary to remove the lime which the hide or skin still contains and to make it soft and pliable.

For each large hide or skin buy 3 ounces of U.S.P. lactic acid (or 9 ounces of tannery 22 per cent lactic acid). Nearly fill a clean 40- to 50-gallon barrel with clean, cool water, and stir in the lactic acid, mixing thoroughly with a paddle. Suspend the sides in this solution for 24 hours or overnight, plunging them up and down occasionally.

For light skins, weighing less than 15 pounds, use only 1 ounce of U.S.P. lactic acid in about 20 gallons of water.

If lactic acid can not be obtained, use 1 pint of vinegar for every ounce of lactic acid. An effort should be made to get the lactic acid, for vinegar will not be as satisfactory, especially for the medium and smaller skins.

After drenching, work over both sides of the hide or skin, as directed under "Liming."

For sole, belting, and harness leathers, hang the sides in a barrel of cool water overnight; then proceed as under "Tanning."

For thin, softer leathers from the small skins, simply rinse off with water after working from the drench. Do not soak in water overnight, but proceed to the "Tanning."

TANNING.

The tanning solution should be made up at least two days before it is to be used; that is, not later than when the hide or skin is taken from the limewater for the last time.

Remember that this is a chemical process and all materials must be of good quality and accurately weighed, and that the specified quantities of water must be carefully measured.

The following chemicals are required: Chrome alum (chromium potassium sulphate crystals); soda crystals (crystallized sodium carbonate); and common salt (sodium chlorid). Insist upon pure

chemicals of U.S.P. quality. Get them from the nearest drug store or find out from it the address of a chemical manufacturing concern which can supply you.

For each hide or skin weighing over 30 pounds, use the following quantities for the stock chrome solution:

Dissolve $3\frac{1}{2}$ pounds of soda crystals (crystallized sodium carbonate) and 6 pounds of common salt (sodium chlorid) in 3 gallons of warm, clean water in a wooden or fiber bucket. The soda crystals must be clear or glasslike. Do not use the white crusted lumps. *This is important.*

At the same time dissolve, in a large tub or half barrel, 12 pounds of chrome alum (chromium potassium sulphate crystals) in 9 gallons of cool, clean water. This will take some time to dissolve and will require frequent stirring. Here again it is important to use only the very dark, hard, glossy purple or plum-colored crystals of chrome alum, not the lighter, crumbly, dull lavender ones.

When the chemicals are dissolved, which can be told by feeling around in the tubs with a paddle, pour the soda-salt solution slowly in a thin stream into the chrome-alum solution, stirring constantly. Take at least 10 minutes to pour in the soda solution. This should give one solution of about 12 gallons which is the *stock chrome solution*. Keep this solution well covered in a wooden or fiber bucket, tub, or half barrel.

To start tanning, pour one-third (4 gallons) of the stock chrome solution into a clean 50-gallon barrel and add about 30 gallons of clean, cool water; that is, fill the barrel about two-thirds full. Thoroughly mix the solution in the barrel and suspend in it the sides taken from the drenching. Work the sides about and stir the solution frequently, especially the first two or three days. This helps to make the sides evenly colored and should be done every hour or so throughout the first day. Keep the suspended sides as smooth as possible.

After three days, temporarily remove the sides from the barrel, add one-half of the remaining stock chrome solution, thoroughly mixing it with that in the barrel, and again hang in the sides. Move the sides about and stir the solution three or four times each day.

After three more days, again temporarily remove the sides, and pour into the barrel the rest of the stock chrome solution, thoroughly mixing it with that in the barrel, and again hang in the sides. Move the sides about and stir frequently as before.

After three or four days in this solution, cut off a small piece of the thickest part of the hide, generally in the neck, and examine the freshly cut edge of the piece. If the hide seems to be evenly colored greenish or bluish all the way through, the tanning is about

finished. Boil the small piece which you have just cut off in water for a few minutes. If it curls up and becomes hard or rubbery, the tanning is not completed and the sides must be left in the tanning solution for a few days more, or until a small piece when boiled in water is changed little if at all.

The foregoing quantities and directions have been given for a medium or large hide. For smaller hides and skins the quantities of chemicals and water can be reduced. For each hide or skin weighing less than 30 pounds, or for two or three small skins together weighing not more than 30 pounds, the quantities of chemicals may be cut in half, giving the following solutions:

For the soda-salt solution dissolve $1\frac{3}{4}$ pounds of soda crystals (crystallized sodium carbonate) and 3 pounds of common salt (sodium chlorid) in $1\frac{1}{2}$ gallons of clean water.

For the chrome-alum solution dissolve 6 pounds of chrome alum (chromium potassium sulphate crystals) in $4\frac{1}{2}$ gallons of cool, clean water.

When the chemicals have dissolved pour the soda-salt solution slowly into the chrome-alum solution as already described. This will give one solution of about 6 gallons which is the *stock chrome solution*. For the lighter skins tan with this solution, exactly as directed for medium and large hides, adding one-third, that is, 2 gallons of this stock chrome solution, each time, and begin to tan in about 15 gallons of water instead of 30 gallons. Follow the directions already given as to stirring, number of days, and testing to determine when tanning is completed. Very small, thin skins probably will not take as long to tan as will the large hides. The boiling-water test is very reliable for showing when the hide is tanned.

WASHING AND NEUTRALIZING.

When the hide or skin is tanned, take the sides out of the tanning solution and put them in a barrel of clean water. The barrel in which the tanning was done can be used after it has been thoroughly washed. (When emptying the tanning barrel be sure to carefully dispose of the tanning solution. While this solution is not poisonous to the touch, it would probably be fatal to the animals and stock of the farm should they drink it, and is furthermore harmful to the soil.) Wash the sides in about four changes of water. For medium and large hides, dissolve 2 pounds of borax in about 40 gallons of clean water and soak the sides in this solution overnight. For smaller hides and skins, weighing less than 25 pounds, use 1 pound of borax in about 20 gallons of water. The sides or skins should be moved about in the borax solution as often as feasible. After soaking overnight in the borax solution, remove the sides and wash them for an entire day,

changing the water 5 or 6 times. Take the sides out, let the water drain off, and proceed as under "Dyeing black." If it is not desired to blacken the leather, proceed as under "Oiling and finishing."

DYEING BLACK.

Water-soluble nigrosine.—One of the simplest and best means of dyeing black is with nigrosine. Make up the dye solution in the proportion of a half ounce of water-soluble nigrosine dissolved in 1½ pints of water. Be sure to get water-soluble nigrosine. Evenly mop or brush this solution over the wet chrome leather after draining as already directed and then proceed as directed under "Oiling and finishing."

Iron liquor and sumac.—If water-soluble nigrosine can not be obtained, a fairly good black can be produced with iron liquor and sumac. To make the iron liquor, mix clean iron filings or turnings with a half gallon of good vinegar and let stand for several days. See that there are always some undissolved filings or turnings in the vinegar. For a medium or large hide, put 10 to 15 pounds of dried, crumbled sumac leaves in a barrel containing 35 to 40 gallons of warm water. Stir well and, when cool, hang in it the wet, chrome-tanned sides. Leave the sides in this solution for about two days, plunging and mixing the solution frequently. Take out the sides, rinse off all particles of sumac, and evenly mop or brush over with the iron liquor. Rinse off the excess of iron liquor and put the sides back in the sumac overnight. If not sufficiently black the next morning, mop over again with iron liquor, rinse, and return to the sumac solution for a day. Take out of the sumac, rinse well, and scrub thoroughly with warm water. Finally wash the sides for a few hours in several changes of water.

While both of these formulas for blackening have been given, it is recommended that water-soluble nigrosine be used whenever possible, as the iron liquor and sumac formula is somewhat troublesome and may produce a cracky grain. After blackening, proceed as under "Oiling and finishing."

OILING AND FINISHING.

Thin leather.—Let the wet tanned leather from the dyeing, or from neutralizing if not dyed, dry out slowly until very damp. Then go over the grain side with a liberal coating of neat's-foot or cod oil. While still damp, tack the sides out on a wall or tie in a frame, being sure to pull out tight and smooth, and leave until dry. When dry, take down and dampen well by dipping in warm water or by rolling up in wet sacking or burlap. When uniformly damp and limber, go over the sides with a "slicker," working them out

on the grain side in all directions. (A slicker can be made from a piece of copper or brass about one-fourth inch thick, 6 inches long, and 4 inches wide. One long edge of the slicker is mounted in a wooden handle and the other long edge, well rounded, is used to work over the sides by pushing hard against them and away from yourself.) After slicking, it may be necessary to "stake" the leather. That is done by pulling the damp leather vigorously back and forth over the end of a small smooth board about $2\frac{1}{2}$ feet long, 6 inches wide, and 1 inch thick, fastened upright and braced to the floor or ground. The top end of the board must be shaved down to a wedge shape, with the edge not more than one-eighth inch thick and the corners well rounded. Pull the sides or skins backward and forward over this edge, flesh side down, exactly as a cloth is worked back and forth in polishing shoes. Let the sides dry out thoroughly again, and, if not sufficiently soft and pliable, dampen with water, apply more oil, and slick and stake as before. The more time given to slicking and staking, the smoother and more pliable the leather will be.

Thick leather.—Thick leather from the larger hides is oiled and finished in a slightly different manner. For harness and strap leather let the tanned sides, dyed if desired, dry down until still quite damp. Then slick over the grain side thoroughly and apply a liberal coating of neat's-foot or cod oil. Tack on a wall or tie in a frame, stretching the leather out tight and smooth, and leave until dry. Then take down, dampen with warm water until limber and pliable, and apply to the grain side a thick coating of a dubbin made by melting together about equal parts of cod oil and tallow or neat's-foot oil and tallow. This dubbin when cool must be soft and pasty but not liquid. If too nearly liquid, add more tallow. Hang up the sides again and leave until thoroughly dried. When dry, remove the tallow from the surface of the leather by working over with the slicker. If more grease in the leather is desired, dampen again and apply another coating of the dubbin. When again dry, slick off the tallow and thoroughly work over all parts of the leather with the slicker. Rubbing over with sawdust will help to take up any surface oiliness.

Chrome-tanned leather is inclined to be stretchy, so that in cutting up the leather for use in harness, straps, reins, and similar articles it is best to first take out most of the stretch.

Chrome leather for shoe soles must be heavily greased, or, in other words, waterproofed, unless it is to be worn in extremely dry sections of the country. Waterproofing may be done after repairing the shoes by setting them in a shallow pan of oil or grease, so that just the soles are covered by the grease. The soles should be dry before setting them in the melted grease. Melted paraffin wax will do,

although it makes the soles stiff. The simple formulas given on page 11 are satisfactory for waterproofing chrome sole leather.

ALUM-TANNED LACE LEATHER.

Lace leather should be made from good sound hides, preferably steer hides. The weight of the hides used may vary from 20 to 40 pounds, depending upon the thickness of leather desired.

SLAKING LIME.

Place about 6 pounds of burnt or caustic lime in a clean wooden tub. Add about 1 quart of water. As the lime begins to slake, add more water, a little at a time, to keep the lime moist; do not pour in water enough to quench the slaking. After the lime appears to be slaked, stir in a gallon or two of clean water. Do all this just exactly as you would make whitewash. Slake the lime the day you start soaking the hide, and keep the tub covered until used.

If burnt lime is not available, fresh hydrated lime (not air-slaked) may be used. In this case stir 8 pounds of hydrated lime into a barrel of water and proceed as directed under "Liming."

SOAKING AND CLEANING.

If the hide has been salted, shake vigorously to remove most of the salt. Spread it out, hair side down, and trim off the tail, head, ears, all ragged edges, and shanks.

Place the hide, hair side up, lengthwise, over a log or board, and, with a sharp knife, cut it from nose to tail, straight down the backbone line, into 2 "sides." It will be more convenient in subsequent handling, especially when the hide is large, to then split each side lengthwise into 2 strips. The back strip will make the better leather and should be about twice as wide as the belly strip.

Fill a barrel with clean, cool water. Place the strips in the barrel to soak for two or three hours, with frequent stirring, to soften the sides and loosen and soak out the blood, dirt, manure, and salt. Take the strips out of the barrel and place them, one at a time, hair side up, on a smooth slab, log, or thick planed board, from 1 to 2 feet wide and 6 to 8 feet long, one end of which rests on the floor and the other extends over a box or trestle so as to be about waist high. Scrub off all dirt and manure, and wash with several bucket-fuls of clean water.

Now turn the strip over, flesh side up, and carefully cut off most of the meat or flesh. Work over the entire flesh side with the back edge of a drawing or butcher knife, held firmly by both ends, while pushing away from you hard against the strip. Wash off with a bucket or two of clean water. This working over should always

be done. Refill the barrel with clean, cool water and put the strips back. Pull them up and stir frequently until they are soft and flexible. A green hide usually needs to be soaked for not more than 10 to 20 hours; a green salted hide for not more than 20 to 40 hours.

When the strips are properly softened, throw them over the slab or beam and thoroughly scrape off all remaining flesh or meat with the back edge of the drawing or butcher knife. It is of the greatest importance to remove all of this meat. When it can not be scraped off, cut it off, but be very careful not to cut into the hide itself. Even should there appear to be no flesh to take off and nothing appears to be removed, it is necessary to thoroughly work over the flesh side in this way with the back of a knife. Finally wash off with a bucketful of clean water.

LIMING TO REMOVE THE HAIR.

Wash out the soak barrel. Pour in the slaked lime; nearly fill the barrel with clean, cool water; and stir thoroughly. Hang each strip, hair side up, over a separate piece of rope and suspend in the limewater. Fasten the ends of the ropes to the barrel so that the strips are entirely covered by the limewater, and cover the barrel with a bag or board. Pull up the strips and stir the lime three or four times each day until the hair will rub off easily from all parts of each strip. This will take from 5 to 8 days in summer and from 6 to 16 days in winter.

When limed, throw the strips, hair side up, over a smooth, slanting slab or board, and, with the back of a drawing or butcher knife, held nearly flat against the hide, push the hair off. If the hide is sufficiently limed, a curdy or cheesy layer of skin rubs off with the hair. If this layer does not thus rub off, the strips must be returned to the limewater. After removing the hair, put the strips back in the lime for another day, until any fine hairs that may remain can be easily rubbed off. Now thoroughly work over the grain or hair side with the back of the knife to "scud" out as much lime, fat, and dirt as possible. Turn the strip over and do the same thing, being sure to remove any meat that may remain on the hide. Then throw the strips into a wooden or fiber tub of clean, lukewarm water and let them remain for from six to eight hours, stirring occasionally.

DRENCHING.

Drenching is necessary to remove the lime which the hide still contains and to make it soft and pliable.

Buy 3 ounces of U. S. P. lactic acid at the drug store. Nearly fill a clean barrel with clean, cool water, and stir the 3 ounces of lactic

acid into it with a clean paddle. Take the strips out of the tub of water, throw them into the barrel of acid, and pull up and stir frequently for 10 to 12 hours or overnight. Now work over or "scud" thoroughly both sides of each strip as is directed under "Lim-ing," and put them in a tub of cool, clean water.

Lactic acid helps to make a softer leather, but if it can not be bought use $\frac{1}{2}$ gallon of vinegar instead.

TANNING.

While the strips are being drenched, thoroughly wash out the barrel in which the hide was limed. Place in it 15 gallons of clean water and 12 pounds of ammonia alum, or potash alum, and stir frequently until it is completely dissolved.

Dissolve 3 pounds of washing soda (crystallized sodium carbonate) and 6 pounds of salt in 5 gallons of cold, clean water in a wooden bucket. The soda crystals must be clean and transparent (glass-like). Do not use white opaque lumps.

Now pour the soda solution into the alum solution in the barrel very, very slowly, stirring the solution in the barrel constantly. Take at least 10 minutes to pour in the soda solution in a small stream. If the soda is poured in rapidly the solution will become milky, and it will not tan. The solution should be cool, and enough water should be added to nearly fill the barrel.

Hang each well-washed strip from the drench in the alum-soda solution. Pull up the strips and stir the solution six to eight times each day. (Do not put the bare hands in the liquor if they are cut or cracked or have sores on them. The alum will make them worse.)

After six or seven days, remove the strips from the alum-soda solution and rinse well for about one-fourth hour in clean, cold water. Drain on clean boards for one-half hour; then hang up by one edge to dry in a moderately warm place free from drafts. Turn the strips every hour, so that first one edge and then the other is up. If this is not done, the lower edge may become cracky. Be sure not to let the strips dry completely and become stiff. If one part of the strip dries faster than another, which is especially likely to occur on the edges, moisten these drier places with water.

While the strips are yet damp but have become somewhat stiff, about like a bridle or driving rein, and can be sharply bent without cracking, begin to work or "stake" them. That is, pull them vigorously back and forth lengthwise over the end of a small smooth board, about $2\frac{1}{2}$ feet long, 6 inches wide, and 1 inch thick, fastened upright and braced to the floor or ground. The top end of the board must not be more than one-eighth inch thick and the corners must be well rounded. Pull the strip backward and forward, flesh

side down, exactly as a cloth is worked backward and forward in polishing shoes. Do this vigorously, but do not cut holes in the hide. The strips must be staked very thoroughly all over in order to make them pliable and soft. The more time given to the staking, the more pliable the lace leather will be. The staking must be done in a clean place where the strips will not get dirty.

After staking, lay the strips flat on a large, low table or on smooth boards, grain side down, and go over the flesh side thoroughly with the back of the knife, or better, with a piece of wedge-shaped hickory, about 6 inches square and one-half inch thick at the head of the wedge. The narrow end of the wedge should be from one-thirty-second to one-sixteenth inch thick and very smooth. Work the flesh side of the hide with this slicker, holding it in both hands by the top and pushing away from you, to remove all adhering flesh and dirt. Turn the strip over and work the grain side also.

Melt together 3 pounds of tallow and 1 pint of neat's-foot, cod, or fish oil. While the strips are still soft and uniformly damp (if they are not damp at this stage, cover them in damp sawdust until they are uniformly moist all over, but not wet). Rub a heavy coat of the melted grease mixture all over both sides of each strip. This should be done in a very warm place, and the grease should be as hot as the hand can bear without discomfort.

Roll the greased strips together and keep them in a very warm place for two or three days. Unroll and again stake thoroughly. If too dry and stiff to stake readily, cover them with damp sawdust until they are soft enough. After drying, if the leather is not sufficiently soft and pliable, again apply dubbin to both sides exactly as before, and lay away rolled for two days. Again stake and then work over both sides with the hickory slicker to more thoroughly work in the grease and remove the excess.

The strips should now be very supple and pliable, even after they are thoroughly dried out. If they are not, they must be vigorously and thoroughly staked all over and redubbed with oil only, staked, and slicked, until they remain soft and pliable. Thorough, vigorous staking of the nearly dry leather is absolutely essential to produce the desired softness and pliability. When dry, soft, and pliable, the leather is ready for use.

